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Liu, Tiansen; Liu, He; Zhang, Yufeng; Song, Yazhi; Su, Yi; Zhu, Yue

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Linking governance structure and sustainable operations of Chinese manufacturing firms: The moderating effect of internationalization

ABSTRACT

Based on 2,775 firm-year observations of Chinese manufacturing firms (CMFs) as their significant impact on mitigating climate change and distinctive governance structures, this paper examines whether CMFs' internationalization degree (INTD) improves the effect of their governance structure (GS) on sustainable operations (SO). Specifically, we define GS from aspects of ownership concentration, size of independent director, and state-holding intensity. Through OLS regression, Fixed Effect Test, and Random Effect Test, the change of SO can be robustly explained in a systematic manner. Empirical results present that CMFs' INTD is lower in general. Stronger state-holding can significantly improve SO, and INTD can motivate ownership concentration to act on SO. Further, INTD that exceeds the average of all sample significantly improves ownership concentration's effect on SO, but lower INTD is unable to promote any GS indicator to produce a positive effect. Additionally, the size of independent director has not been able to improve SO. Our findings indicate that key shareholders' decision-making authority more directly guides firms' sustainability, and thus CMFs with centralized governance mode are more likely to develop SO. What's more, global-market expansion provides a feasible path that helps link corporate governance and SO.

Keywords: Corporate governance; Sustainable operations; Size of exported products; Internationalization; Chinese manufacturing firms

1. Introduction

It has been widely perceived that an effective corporate governance is related to sustainable operations (SO) in economic and environmental terms (Wijethilake, 2017; Haque and Ntim, 2018). In this field, SO

stands for a set of skills or management concepts that incorporate business practice into performance as relevant to ecological, economic, and societal sphere, i.e. a kind of operational mode targeting at meeting demands of firms and their stakeholders for sustainable development (Kleindorfer et al., 2005; Gimenez et al., 2012; Tang and Zhou, 2012). The theoretical links between governance structure (GS) and SO were investigated in corporate governance literature from the perspective of how GS leading different types of sustainable performance to quantify the effect of internal governance that remains stable over a period of time on firms' SO (Galbreath, 2010; Walls et al., 2012; Iatridis, 2013). To firms, GS is a kind of mode that aims to protect stakeholders' interests, and it has increased ongoing concerns over what kind of GS will more effectively guide firms' social behaviors (Wall et al., 2012; Singh and Gaur, 2013). There are a lot of observations concluding that GS can contextually affect SO. For instance, Wall et al. (2012) and Amran et al. (2014) found that board of directors and key shareholders play key effects in guiding sustainability issues, but their effects are less significant in some Asia-Pacific economies, which triggers an interesting research at interface between two lines of studies from international business and corporate governance as relevant to SO, respectively.

The international business literature acknowledged that entering overseas markets will improve firms' economic, innovative, and green performance in emerging economies (Zhu et al., 2011; Deng and Zhang, 2018). It has suggested that investigating variables related to firms' feature and then identifying multiple links between internationalization degree (INTD) and sustainable strategy will expand the knowledge of social effect of globalization because SO involves aspects of ecological protection and social fairness, with expanding SO's antecedents as well (Chiarvesio et al., 2015). Further, INTD's boundary in terms of GS and SO can be framed in export and overseas investment, i.e. the cross-border transfer of key production factor (Chiarvesio et al., 2015; Deng and Zhang, 2018). Meanwhile, international business literature tested how different ownership structures can lead to the change of firms' INTD, and factors at the operations level, e.g. incentive alignment and risk bearing, can further alter the effect of GS on INTD (Alessandri and Seth, 2014; Gaur and Delios, 2015). However, it still exists a gap on how INTD links

corporate governance and sustainable development. Answering this question will verify whether the size of overseas customers can attract firms' focus on sustainability, which also echoes prior studies, e.g. van Marrewijk (2003). Further, even if a firm established a trust with overseas consumers in the early stage, they still need to remain this business tie through innovative operations modes, e.g. innovation of export capabilities or products due to the complexity of global market that can trigger a change in consumption structure of specific product (Nakos et al., 2019).

Besides prior literature that focused on the key position of international strategies in firms' operations management, the Agency Theory also helps consolidate the link among GS, INTD, and SO. The key task of this theory is to address how clients design the optimal contract to motivate agents in interest conflicts and information asymmetry (Jensen and Meckling, 1976), also as a cornerstone of corporate governance (Lan and Heracleous, 2010). With respect to the extension of this theory in social and ecological systems affiliated to business organization, the Theory of Transformative Agency was proposed to explain broad diversities of organizational strategies (Westley et al., 2013). The evolution of Agency Theory implies that its principle can be used to interpret different occasions (Wiseman et al., 2012). With global trading being a key strategy for broader range of firms, their top management needs to respond to a public expectation that firms should establish sustainable operations that may drive the expansion of future markey shares in turn (Calvo and Calvo, 2018). Prior literature indicated that corporate governance is a key to address stakeholders' agency conflicts (Kumar and Zattoni, 2017). From this view, an important work entrusted to stable governance structure is to deal with firms' sustainable development, thus echoing stakeholders' expectations because a key role of firms is social being. In this process, top management needs to control risks and thus enhance market value through global-market expansion to keep firms' competitive edges. Accordingly, the core effect of internationalization can be seen an opportunity that leads firm's initial GS to play more important effects. Based on the core task of Agency Theory and in the context of linking GS, INTD, and SO, firm can be seen as clients because they need overseas customers' involvement in product buying-and-selling that may motivate firms' initial GS to devote to sustainable development. Conversely,

customer as agents will benefit from cleaner products created by firm's SO, and this interaction is also an embodiment of integrating conformity to institutional norm and pursuit of market expansion (Heugens and Lander, 2009).

Driven *by Made in China 2025* and *Belt and Road Initiative*, there is an increasing focus on the sustainable development of Chinese manufacturing firms (CMFs), thus leading the rise of their global status (Weber, 2014; Maung et al, 2016). In this context, expanding the scale of manufactured products in global markets will not only benefit firms' financial performance, but also improve both ecological and societal elements through global supply-chains (Du and Zhang, 2018). At present, more CMFs are voluntarily and strictly carrying out universally recognized standards because on the whole, their top management, employees, and customers are all striving for the progress of firm sustainability (Shuai et al., 2014; Weber, 2014). But in view of China's huge economic scale, SO is still controversial in CMFs. Yang et al. (2019) investigated what kind of SO is more compatible with CMFs' sustainable strategies, environmentally or economically sustainable? And it exists an imbalance among ecological, economic, and societal spheres. Some research investigating Chinese firms' sustainability was organized following international standards (Weber, 2014; Chen et al., 2015), and this evaluation method has been broadly used, which implies a high similarity of SO's essence worldwide (Marimon et al., 2012; Fernandez-Feijoo et al., 2014; Vigneau et al., 2015). Further, a centralized ownership distribution in listed or state-owned CMFs implies key shareholders rather than the market-driven to be more decisive for corporate governance, which is almost contrary to developed economies (Liu, 2005). Following research focus in the knowledge area of firms' internationalization and the unclear link among GS, INTD, and SO, this paper analyzes how CMFs' INTD can moderate the effect of GS on SO.

In doing so, this paper will contribute to existing literature from following research perspectives. First, it expands knowledge areas on effects of international strategy on sustainability issues of manufacturing firms. Unlike other industries, manufacturers' sustainability focuses more on the ecological profile that is a global concern, especially in emerging economies that need to address the dilemma in terms of cleaner

production through developing multi-strategies. Recent perspectives began to connect indicators related to cleaner production, e.g. environmental strategies and eco-innovation, with internationalization (Chen et al., 2016; Hojnik et al., 2018), and they suggested future research to extend environmental issues to the sustainable development. Following prior research strands, this paper theoretically analyzes how INTD link with SO to verify whether global vision can help business organizations' clean development that is with the overall greenization in ecological, economic and societal spheres. Meanwhile, market expansion implies a broader customers' demand in products with clean features. Thus this paper will also develop a theoretical insight into sustainable values that customers can create (Biju et al., 2015). As an influential industrialized economy, improving firms' SO in China can set a benchmark for creating competitive edge of the manufacturing in emerging economies. Different from existing literature, this paper will focus on an important problem CMFs recently face, i.e. how to use the merit of globalization strategies to improve their sustainability that is not very long-standing because the average life span of Chinese firms is rather limited (Xie, 2017). In this case, besides the driving effect of governance mode, it should further identify more dynamic factors in firms that may improve the lack of sustainability. Based on a fact that CMFs are striving for integrating into global markets, this paper analyzes whether their INTD can play an effect in improving SO. Second, this paper further theoretically and empirically interprets how INTD moderates the effect of GS on SO. As a firms' profile, GS can guide top management to organize routine works, and existing literature suggested various indicators in measuring GS. Prior studies examined the effect of GS on SO, e.g. Amran et al. (2014), but they less focused on whether it exists some variables that may further improve or alter GS's effect in SO. To enrich it, this paper expands the link path of GS and SO in view of the key effect of INTD in leading firms' operations management (Chiarvesio et al., 2015). It will enhance the knowledge area on how INTD leads internal governance to focus on firms' sustainability issues, also echoing suggestions of Wiseman et al. (2012) that argued flexibly using the Agency Theory in variety of non-traditional settings. Third, this paper expands the existing knowledge in GS as the dominant role of state-owned shares in CMFs. Based on this special governance form, the analysis on how GS leads to SO

will provide a key implication for top management when they are improving firms' sustainability from the perspective of initial decision-making. Expectedly, this paper reveals how CMFs adjust international strategies targetting at SO through improving internal governance.

The rest of this paper is organized as follows. After this introduction, we review the relevant literature and develop hypotheses to expand the boundary of existing knowledge. The research methodology will be introduced followed by empirical results of our analysis. After that, we propose theoretical as well as practical implications based on key findings. Finally, we conclude this paper and set directions for future research based on potential limitations of this paper.

2. Literature review and hypotheses development

2.1. The development of SO in CMFs

CMFs are still strongly relying on traditional energy, and their significant effects on China's economy indicates that firms' operations will greatly guide the sustainability of whole society (Li et al., 2019). In terms of the indicator design for SO, the *Sustainability Reporting Guidelines* compiled by Global Reporting Initiative (3.1 version) summarizes following aspects, i.e. institutions' profile, strategic analysis, economy, ecological environment, labor practice with decent work, human rights, society, and products liabilities. These indicators describe the aspect in which firms should focus on SO and develop feasible approaches for quantifying the sustainability of specific operations mode.

With respect to the existing SO in CMFs, Long et al. (2016) concluded that there is no unified system to evaluate SO for key manufacturing sectors, which implies that CMFs' SO has not yet been involved in a unified management mode from the perspective of the whole country. Further, the close political link of CMFs leads government to regulate industrial policies (Maung et al., 2016), thus lack of unified practical framework for SO means that firms may not present a clear orientation, thereby impeding the design of climate-friendly industrial structures in China.

Some studies further supported the lower SO performance in CMFs. For instance, Industrial Symbiosis

programs broadly practiced in developed economies are still at an initial phase in China (Wen and Meng, 2015; Sun et al., 2017). In view of this case, recent research advocated the cooperative SO among firms as a kind of market selection aiming to break a traditional state that resources flow is dominated by policies (Zhang and Wang, 2014). This case implies that firms dispersedly organizing SO will enhance operations cost that is also a challenge for CMFs. Additionally, expanding industrial engineering network will help improve the overall efficiency of manufacturers' operations process through resources-sharing (Zhang et al., 2016), but in China's industry clusters, this network mode is not broadly practiced. That is, associated industrial sectors have not been integrated into a unified Internet framework. Accordingly, a picture can be described as that CMFs' SO is in a decentralized state as a whole, and the cooperation mode for firms' sustainability improvement is not substantially designed. Overall, industrial policies for normalizing SO are being systematically formulated, while such policy is better implemented in Eastern China in general where is economically-developed (Wang and Feng, 2015). Thus CMFs' SO should be urgently improved in underdeveloped areas.

2.2. The effect of firms' GS on SO

Linking governance mode and sustainability is a hotspot in the area of firms' sustainable development, and lots of studies examined their relationships through diversified indicators design. Based on Ciftci et al. (2019), GS includes two systems, i.e. internal governance (relation-based management) and external governance (market-based management). Early GS literature suggested that it can initially lead to firms' development orientation, thus as a determinant of firm performance (Demsetz and Lehn, 1985; Demsetz and Villalonga, 2001). What's more, the dominant role of state-owned shares in CMFs makes GS present obvious political connections at the level of operations.

Based on the Agency Theory, it exists conflicts of interests among firms' stakeholders actually, and the identity of client and agent can contextually vary (Kumar and Zattoni, 2017). In view of the potential link between international business and corporate social responsibility (CSR), firms' top management needs to consider social interactions when developing business strategy as different cultural boundaries among

key stakeholders (van Marrewijk, 2003; Calvo and Calvo, 2018). The conceptual framework of this paper describes that top management needs to be responsible for a series of stakeholders through normalizing internal GS and strategic decision. Thus it is logical to draw that top management acting as a client need to coordinate multi-agents' roles in SO. In prior research, the proxy variables of GS include a broad range of indicators, e.g. ownership distribution, board size, independent director, CEO profile, and managerial control, with the progressive shift towards social issues (Wall et al., 2012; Haque and Ntim, 2018; Ciftci et al., 2019). They found that factors related to ownership and board of directors can more positively affect social issues than the effect of other GS indicators. In view of some GS indicators may lead to a volatility of firms' SO, this paper will investigate following variables involved in GS, i.e. ownership concentration, size of independent director, and state-holding intensity, with specific analysis as follows.

Ownership concentration reflects the extent to which shareholders have a centralized decision-making authority that is a type of controlling capability. Prior studies indicated that this concentration is usually significantly related to CSR but with positive or negative effects in different contexts (Dam and Scholtens, 2013; Peng and Yang, 2014). For instance, in developed economies, concentrated ownership distribution will bring a weak CSR because with less political interventions, shareholders will more consider how to gain direct benefits through decision-making, and decentralized distribution will provide more chances for broad shareholders in terms of their interests. A key premise of this case is that firms instinctively do not rely on industrial policies while focus more on meeting market demands. By contrast, the operations management of CMFs, especially in listed and state-owned firms, is closely linked with industrial policy (Li and Zhang, 2010; Maung et al., 2016). Thus more centralized ownership distribution implies that key shareholders as clients are more likely to focus on few but important issues. Our prior study found that in the case of large-size random samples, the average total proportion of top5 shareholders is about 50% in listed CMFs (Liu et al., 2019). Judged by this, with the concept of sustainable development penetrating into the whole society of China, public expectation to CMFs' SO has involved more and more fields. Thus it can be inferred that in the current phase, ownership concentration in CMFs may lead to positive

SO as a whole, which is also in line with their increasing sense of social responsibility to cater for earning public trusts. Based on above analysis, we develop the following hypothesis.

Hypothesis 1. Ownership concentration positively affects CMFs' SO.

Further, the size of independent directors describes the internal supervision intensity (Luan and Tang, 2007; Armstrong et al., 2014). As an outsider relative to internal management layer, independent director has been entitled to exercise the right to prevent key shareholders from damaging firms' overall interests, and they can help enhance the transparency of information released by firms through monitoring duties, thus consolidating public perceptions to firm growth (Patelli and Prencipe, 2007; Armstrong et al., 2014). Based on the Agency Theory, as an agent entrusted by top management and independently evaluates the issues in firms, two critical duties of independent director are leading key shareholders to make decision in professional and legal manners based on rare resources, and planning firms' future development, e.g. what fields need to be focused on in the coming period (Luan and Tang, 2007; Masulis and Mobbs, 2014). In China where the treatment of CSR has not yet reached a mature phase, and lots of CMFs were recently suggested to conduct a robust social responsibility system with the substantial improvement in practice, e.g. Cumming et al. (2016). Further, as independent directors' opinions are legally protected, this special identity will help prevent stakeholders from being infringed (Tang et al., 2013). Overall, the independent directors of Chinese firms are endowed with a robust role in leading SO from the perspective of internal regulation, and thus the size of independent directors will characterize whether they can consolidate SO of CMFs. Based on above analysis, we develop the following hypothesis.

Hypothesis 2. The size of independent directors can positively affect CMFs' SO.

What's more, widespread state-owned shares of CMFs imply the close link between shareholders and policy steering. Smith et al. (1996) found the obvious disparity between top management of Chinese and Western manufacturers in code of conduct when coping with key issues. Quite a number of listed CMFs are with a large-size of state-owned shares, but such ownership distribution in the West is decentralized, thus leading to the effect of key shareholders on firm development in China more significant than that of

market force, which is contrary to the West. In this case, China's key shareholders may present a higher degree of obedience to established procedures/rules when organizing SO, and this state also reflects their initial intention to specific operations process (Liu, 2005; Li and Zhang, 2010). With the volatility of state-owned shares size, it will alter the external manifestation of SO (Tam, 2002). Prior studies were debatable whether state-holding can evidently improve firms' CSR or sustainability, and some studies even found that state-owned firms weakly motivate SO compared with ones with other ownership structures (Wang and Jin, 2007). Overall, prior studies more emphasized the role of state-holding in leading firms to fulfill social responsibility in China, and recent studies also supported that the stronger state-holding intensity will help enhance Chinese-listed firms' social responsibility performance (Xu and Zeng, 2016). Based on above analysis, this paper develops the following hypothesis.

Hypothesis 3. State-holding intensity positively affects CMFs' SO.

2.3. How INTD moderates the effect of GS on SO?

González-Benito and González-Benito (2006) theoretically presented that firms' globalization level will affect environmental governance through multi-paths, e.g. knowledge transfer among industrial sectors, new environment policy release for meeting green needs of importing economies, and new opportunity creation to benefit from more available resources. In the emerging economies, firms' pollutant emissions scale varies with the goal of products sales to local customers, multinational corporations, and overseas markets although in one economy, most firms follow similar sustainability policies (Daly and Goodland, 1994). After that, some literature introduced how important internationalization is to SO (Kleindorfer et al., 2005), thereby establishing their direct link.

The spatial agglomeration, resource-based innovation, and value-chain perspectives can help explain the relationship between internationalization and firms' eco-innovations or environmental performance. These views present how international expansion or local sourcing will lead to sustainable development of firms, also describing products flow that can produce spatial economic effects. In this process, ideas in terms of sustainability may further enhance the value of SO by means of entering global markets. That is,

geographic location of core products, sustainable behaviors, and final value of these behaviors should be integrated for enriching paths of firms' SO (Chiarvesio et al., 2015; Hitt et al., 2016).

With respect to the potential effect of INTD in moderating of GS on SO, following picture is described based on actual status of these variables in firms. GS was seen as an initial determinant for some types of firm performance (Baysinger et al., 1991; Thomsen and Pedersen, 2000; Jansson, 2005; Galbreath, 2010). In practice, GS adjustment is usually committed to enhancing firm value, and within a specific economic or institutional environment, GS steadily affects some types of firm performance (Demsetz and Lehn, 1985). While in reality, GS should not be adjusted arbitrarily, and thus some firms that experienced a downturn may consider overcoming defects in GS through some paths. In this case, the moderating effect of some variables is to explore how to improve GS's initial effects (Nguyen et al., 2015).

In terms of internationalization that can help enhance firms' popularity and financial performance, the Resource-based Theory clarifies that it relies on the promotion of special resources held by firms, and the value of these resources will be further concretized in the process of operations management (Hitt et al., 2006; Hitt et al., 2016). Underpinned by it, higher INTD implies that firms need to more broadly present their sustainability (Vigneau et al., 2015; Kolk, 2016). Thus operations strategies from global perspectives may drive GS-related indicators to focus on sustainability. Further, developing globalization operations strategy suggests firms to develop more strategic types (Nakos et al., 2019). In this process, the coverage of GS-related indicators that may lead SO should be expanded. However, some views argued that export cannot motivate firms to focus on social issues when exporting and importing economies have a similar cognition for activities related to public interests (De Marchi and Grandinetti, 2013). These research also help explain a potential problem on endogeneity between INTD and SO that is internationalization can lead to the development of SO actually. Prior test indicated that internationalization will uncertainly and contextually affect firms' response to social issues, and before examining its effect, it should predict how enhancing INTD can affect the target performance, positively or negatively?

As far as China is concerned, the internationalization of Chinese firms is still under-investigated with

piecemeal theoretical supports and limited empirical perspectives, and thus recent research worried that the paths for enhancing their competitive edges through internationalization may not be well explained (Deng, 2012; Li et al., 2018). Overall, the complexity of Chinese firms' GS and market environment brings a significant difference of INTD in leading different types of firm performance, e.g. the concentration on how home institution leads to firms' overseas sales growth (Zhu et al., 2011; Deng and Zhang, 2018). But only few studies investigated how this non-indigenized operations strategy will affect domestic business activities under a powerful policy regulation, especially to activities beneficial to social progress but not easily to be concretized, e.g. Zhu et al. (2011). To enrich it, Deng (2012) suggested that future research on antecedents, process, and consequence of Chinese firms' internationalization requires broader concerns.

Early literature argued that globalization is adverse to climate change mitigation because free trading system can trigger a transfer of industrial pollutants to undeveloped economies. However, the research since the 21st century argued that with an increasingly closer relationship among economies worldwide, more developing economies reduced pollutant emission of manufacturing sectors through sectoral self-regulation to keep their competitive edges. González-Benito and González-Benito (2006) reviewed prior literature on antecedents of firms' environmental proactivity with a finding that internationalization will affect environmental management through more ways. It was supported that multinational corporation or firms in developed economies will consider Chinese firms' sustainable development capabilities when importing their products (Christmann and Taylor, 2001). Further, CMF was divided into several types of internationalization clusters, i.e. the mature, emergent, and domestic-focused internationalization. Firms with deeper global markets are usually accompanied by a greater extent of environmental management practices. What's more, international institutional pressure was observed to improve green operations in CMFs (Zhu et al., 2011; Zhu et al., 2012). It can be judged that it may exist significant disparities in INTD among CMFs, and linking INTD and SO may help create competitive edges in multi-aspects. Integrating above analysis on the potential effect of CMFs' INTD in the relationship between GS and SO, this paper finally develops following hypotheses.

Hypothesis 4. The moderating effect of CMFs' INTD in the relationship between GS and SO is positive but limited.

Hypothesis 5. Higher CMFs' INTD leads to a more positive effect of GS on SO.

2.4. The conceptual model

This paper arrives at a model that can describe the theoretical link among variables as Figure. 1. Above all, this theoretical model will examine the effect of GS on SO and the moderating effect of INTD. Further, we conduct a heterogeneity analysis to present the effect of different levels of INTD. Guided by Figure 1, empirical test will present how firms' initial governance mode evolves into SO via internationalization.

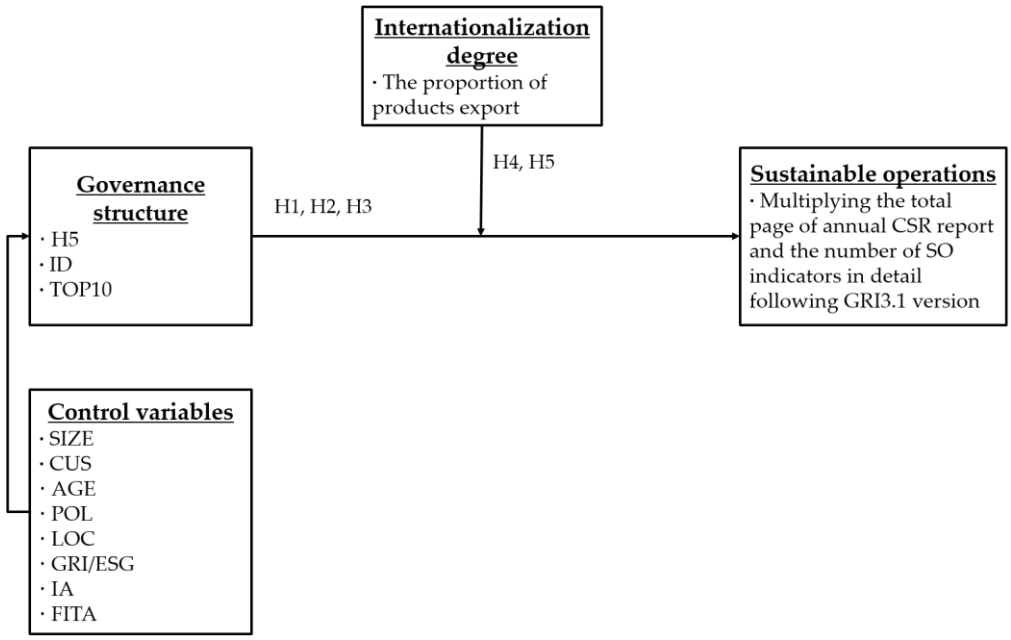

Figure 1. The conceptual model

3. Research methodology

3.1. Data collection

Shanghai Stock Exchange and Shenzhen Stock Exchange have totally published more than 7,000 social responsibility reports of listed firms that cover almost all industrial sectors, and all reports recorded how firms fulfill social responsibilities. Chinese listed firms are obliged to publish social responsibility reports and faithfully record various performance, including firm reputation, green operations, R&D/innovation management, service for stakeholders, supply-chain management, product quality, community building,

and staff's career planning. Some reports also introduce firms' profile, operations mode, and distribution principle of shareholders' revenue. Although firms rarely release negative information regarding social responsibility, almost all firms declare that when compiling CSR reports, they have strictly followed the law, policy, industrial criterion, and international sustainable development guideline, e.g. Company Law, Securities Law, Tax Law, CSR Report Guideline that is complied by Chinese Academy of Social Sciences, and Sustainability Reporting Guideline compiled by Global Reporting Initiative. What's more, almost all firms promised to faithfully and completely publish CSR without any false or omitted information, and they are responsible for all potential errors. Accordingly, we assume that these firms did not exaggerate CSR performance and the data involved in these reports is credible.

This paper adopts the following sampling strategy to reach the investigated firms. Within the range of CSR report published by Shanghai Stock Exchange and Shenzhen Stock Exchange, we firstly identify the firms whose main business belongs to the manufacturing industry. Further, based on the availability and integrity of data for our variables, we extract 2,775 valid CSR reports of CMFs registered on Shanghai or Shenzhen Stock Exchange, i.e. 2,775 firm-year observations from 2010 to 2018.

With respect to the data source, following indicators are surveyed from the CSR report: the level of SO, whether firms publishing their SO following the Sustainability Reporting Guidelines compiled by Global Reporting Initiative (GRI3.1 version) or Environment, Social, and Governance Index compiled by Stock Exchange of Hong Kong Exchange Ltd. (ESG), and whether CSR report using figure or table to visualize important data or actions. Following indicators are surveyed from firms' annual report: total assets, the proportion of sales volume from top 5 customers in annual total sales, whether annual report audited by international certified public accountants' firms, ownership concentration, size of independent directors, total proportion of stated-owned shares held by top 10 shareholders, and INTD. Further, data of firms' listed age, pollution level, and headquarters' location is collected from professional financial website of China "http://www.eastmoney.com/" that also records profile and stock market quotation of listed firms.

3.2. Variables measurement

Dependent variable: The level of SO is designed as dependent variable measured through multiplying the total page of their social responsibility reports (describing the extent to which they have willingness to disclose sustainable performance to the public) and the number of SO indicators they publish in detail following GRI3.1 version (describing the extent to which they broadly focus on SO). This design for SO is motivated by the measuring methods of disclosure quality of sustainable development or environmental information reports. Prior studies suggested that a high quality disclosure should provide a transparent signal that helps stakeholders to visually understand the level of firms' SO and thus make the informed decisions (Iatridis, 2013; Plumlee et al., 2015). Thus this paper designs above two indicators to explicitly present the overview of SO. As our data spans from 2010 to 2018 but GRI4 version was published in 2013, we identify the number of SO indicators published in detail for all CSR reports based on the criterion of GRI3.1 version. Specifically, this version designs 7 indicators introduced in Subsection 2.1 to describe the profile of SO. Accordingly, we identify how many indicators each observation has well engaged in based on the disclosure of CSR reports (well engaged in=1; otherwise=0), thus adding the score of all indicators. With respect to whether each SO indicator being well engaged in, GRI3.1 version has introduced the link between each indicator and institutions' sustainability. Accordingly, if a CSR report both published data related to one indicator and then explained its positive effect on SO, we consider that this indicator was well engaged in.

Independent variable: we arrange ownership concentration as the first independent variable to reflect key shareholders' controlling capability. Prior studies used the shareholding held by top 5 shareholders (H5) or total proportion of shares held by shareholders who owned at least 5% of total shares to describe ownership concentration (Dam and Scholtens, 2013; Nguyen et al., 2015). Accordingly, this paper uses H5 and expresses it as Ln[H5/(100-H5)]. Further, the size of independent directors in all board members (ID) is organized as another independent variable to present whether CMFs' operations management is in the state of normal internal supervision (Luan and Tang, 2007). What's more, the proportion of state-owned shares held by top 10 shareholders (TOP10) is designed as the third independent variable to

present the effect of state-holding as a policy regulation in firms' SO.

Moderating variable: INTD is designed as the moderating variable that is quantified by the proportion of products exported to the overseas markets, including Hong Kong, Macao, and Taiwan, i.e. the export intensity (Li, 2014; Chiarvesio et al., 2015).

Control variables: Based on existing literature, this paper arranges following control variables that can potentially affect the state of GS, INTD, and SO as well as their relationship, to consolidate that empirical results truly present the effect of antecedent of SO, with all definitions in Table 1: (1) Total size (SIZE); (2) The proportion of sales volume from top 5 customers accounting for annual total sales (CUS); (3) Firms' listed age (AGE); (4) Firms' pollution level (POL); (5) Firms' headquarter location (LOC); (6) Organizing SO following the GRI3.1 version/ESG or not (GRI/ESG); (7) Employing international accounting agencies to audit annual performance or not (IA); (8) CSR report using figures or tables to present important data/ actions or not (FITA).

Table 1 presents an overview of all variables, and the standard deviation (S.D.) presents the significant disparity in SO among firms, thus indicating a decentralized level of CMFs' SO. The average of GRI/ESG and IA presents that only few firms organized SO and annual performance audit following international accepted criteria. Further, the average of TOP10 and INTD presents lower size of state-owned shares and weaker global expansion capability of our samples. The data distribution in Table 1 presents a significant heterogeneity among firms, thus preliminarily supporting the randomness of sampling.

Table 1. The overview of variables (raw data, N=2,775)

Variables	Definition	Min.	Max.	Mean	S.D.
SO	*The product of total page of annual CSR reports and number of SO indicators published in detail following GRI3.1 version*	9.00	1440.00	165.94	185.94
SIZE	*The natural logarithm of annual total assets* (Amran et al., 2014; Haque and Ntim, 2018)	18.76	28.57	22.90	1.40
CUS	*The proportion of sales volume from top 5 customers in annual total sales (%)* (Biju et al., 2015; Goettsche et al., 2016)	0.07	100.00	28.49	21.32
AGE	*The time length of firm listing in the Shanghai or Shenzhen Stock Exchange (year)* (Li and Lu, 2016)	0.00	26.00	12.19	6.19
POL	*Non-heavy-polluting firm=0; Heavy-polluting firm=1 based on the Environmental Information Disclosure Guidelines of Chinese Listed Company* (Maung et al., 2016)	0.00	1.00	0.53	0.50

LOC	*Non-eastern province=0; Eastern province=1*	0.00	1.00	0.61	0.49
GRI/ESG	*Organizing SO following GRI3.1 version or ESG=1; otherwise=0* (Fernandez-Feijoo et al., 2014)	0.00	1.00	0.18	0.38
IA	*Employing international accounting agencies to audit annual finance=1, i.e. Deloitte & Touche, PwC, Ernst & Young, and KMPG; otherwise=0* (Fullerton et al., 2014)	0.00	1.00	0.11	0.32
FITA	*Using figure or table in CSR report=1; otherwise=0*	0.00	1.00	0.61	0.49
H5	*The concentration degree of shares held by top 5 shareholders*	10.64	100.00	54.52	16.33
ID	*The proportion of independent directors in all board members (%)*	14.29	71.43	37.30	6.14
TOP10	*The proportion of state-owned shares held by top10 shareholders (%)*	0.00	95.26	27.76	25.70
INTD	*The proportion of annual products export (%)*	0.00	99.35	12.74	19.57
H5×INTD	N/A	0.00	8019.71	672.83	1108.22
ID×INTD	N/A	0.00	5094.86	476.81	741.84
TOP10×INTD	N/A	0.00	7982.15	290.61	679.03

3.3. Data processing and model design

As different measuring units of our variables, we develop following processings for raw data to make their distribution more centralized. First, for variables that are non-dummy with all of data greater than 0 (SO, CUS, and ID), we express them as natural logarithm. Second, for non-dummy variables with some data equal to 0 (AGE, TOP10, and INTD), we standardize them to decrease negative interference of few outliers on empirical results (Amran et al., 2014). To verify Hypothesis 4 and Hypothesis 5, we examine the interactions of H5 and INTD, ID and INTD, and TOP10 and INTD. Further, we divide INTD into two groups, i.e. higher and lower than the average of samples, to present whether higher INTD can enhance the effect of GS on SO, thereby confirming the potential driving force of INTD in firms' sustainability.

Based on above introduction for variables and following Fig.1, we firstly investigate the robustness of these data to present what extent SO can be robustly explained by GS and INTD. Thus we separately use the general OLS estimation model, Fixed Effect Test, and Random Effect Test to verify expected causality. Further, we use the same process to organize heterogeneity test and find that both full data and grouped data are robust because no matter what test method is used, they all present the similar causality. Table 3, Table 4, and Table 5 present all necessary empirical results for each model to support the data robustness, and further robustness test indicates that our findings can extend to a broader range, i.e. deducing to the overall state of CMFs derived from the sample survey. Thus we design the following measuring model.

$$Y_{it} = \alpha + \beta_1 C_{it} + \beta_2 X_{it} + \beta_3 M_{it} + \beta_4 X_{it} M_{it} + \varepsilon_{it} \quad (1)$$

In Equation (1), we name X_{it} as the independent variable, M_{it} as the moderator variable, $X_{it}M_{it}$ as the product of independent and moderator variables, and C_{it} as the control variable. Additionally, α is the constant term, and ε_{it} is the random error term. i indicates the firm-level observation (i=1…2,775), and t indicates the time-level observation (t=2010…2018). Further, we decompose Equation (1) into four test models and then examine the effect of C_{it}, $C_{it} + X_{it}$, $C_{it} + X_{it} + M_{it}$, and $C_{it} + X_{it} + M_{it} + X_{it}M_{it}$ on Y_{it}, respectively.

4. Empirical results

4.1. Correlation analysis

Table 2 presents that firms with larger-size total assets, lower customer concentration, longer listed age, heavy pollution, adopting GRI3.1 version or ESG, employing international accounting agency, and using figure or table in CSR reports will better engage in SO, and variables related to quality of CSR reports, i.e. GRI/ESG, IA, and FITA, present a close interactive correlation. Further, firms with higher H5, larger-size TOP10, or higher INTD is with better SO, but the interaction between INTD and each GS indicator does not positively correlate with SO, which preliminarily indicate that CMFs' international strategy may not well guide their original GS to improve sustainability issues. Following, we examine the causality among GS, INTD, and SO to verify developed hypotheses.

Table 2. Correlation coefficients (Spearman coefficients, N=2,775)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SO	1															
SIZE	0.356***	1														
CUS	-0.083***	-0.087***	1													
AGE	0.051***	0.310***	0.019	1												
POL	0.046**	0.095***	-0.015	0.134***	1											
LOC	0.020	-0.029	-0.034*	-0.145***	-0.140***	1										
GRI/ESG	0.539***	0.308***	-0.053***	0.018	0.022	0.037**	1									
IA	0.190***	0.360***	-0.077***	0.040**	0.031	0.082***	0.186***	1								
FITA	0.650***	0.175***	-0.045**	-0.011	0.003	0.049**	0.327***	0.077***	1							
H5	0.149***	0.227***	0.000	-0.237***	0.111***	0.062***	0.186***	0.255***	0.055***	1						
ID	0.022	0.065***	-0.021	-0.042**	-0.045**	-0.011	0.030	0.042**	0.007	0.054***	1					
TOP10	0.136***	0.360***	0.221***	0.303***	0.189***	-0.128***	0.107***	0.106***	0.030	0.361***	0.000	1				
INTD	0.033*	0.036*	0.022	-0.075***	-0.196***	0.149***	0.050***	0.041**	0.068***	-0.101***	0.017	-0.112***	1			
H5×INTD	-0.048**	-0.121***	0.025	0.063***	-0.100***	-0.040**	-0.112***	-0.109***	-0.020	-0.364***	-0.004	-0.198***	0.213***	1		
ID×INTD	0.023	0.036*	0.030	-0.066***	-0.190***	0.153***	0.045**	0.041**	0.061***	-0.102***	-0.133***	-0.104***	0.969***	0.214***	1	
TOP10×INTD	-0.089***	-0.156***	-0.174***	-0.091***	-0.094***	-0.006	-0.056***	-0.061***	-0.059***	-0.167***	0.004	-0.313***	-0.087***	0.294***	-0.092***	1

Note: *p≤0.10 (Two-tailed), **p≤0.05 (Two-tailed), ***p≤0.01 (Two-tailed).

4.2. Empirical results of full sample

Table 3 presents the effect of GS on SO under the effect of a series of variables in terms of firms' profile and quality of CSR reports through different test methods. The value of R^2 in Table 3, Table 4, and Table 5 present following facts. First, with the increase of variables involved in the measuring model, marginal volatility of SO will be better explained. Second, the large values of R^2 support that in practice, the level of CMFs' SO can be well portrayed by our variables.

As we usually assume the disturbance terms of different individuals are mutually independent within the panel data, this paper also estimates the cluster robust standard errors of variables for each model of Fixed Effect Test and Random Effect Test to present spatial correlations of error terms. Table 3 presents a small cluster robust standard errors that indicate a centralized distribution of firms data at the year-level as a whole, thus verifying the validity of our sample survey. Based on different test processes, this paper portrays the general effect trend of GS and INTD, and then analyzes research implications applicable to China's context.

Further, this paper organizes three tests to verify the quality of our data. First, we develop D.W. test to present the serial correlation of variables, and find that all of D.W. values are around 2, which indicates that the residual of variables obeys normal distribution. Second, we develop Chi-square test to quantify the deviation degree between actual observation and theoretical inference of sample data, and find that the asymptotic significance of each variable is no more than 0.02, which indicates that there is almost no deviation between observed and theoretical values, thus responding to unbiased prediction for variables function. Third, we develop Hausman test to verify the existence of endogeneity within our data, with a result that the level of Prob>chi2 for each model is no less than 0.05, thus verifying the non-endogeneity of variables. Overall, above tests can support high quality of our data and robustness of causality among variables.

Table 3. Empirical results for the full sample (N=2,775)

Variables	Model 1	Model 2	Model 3	Model 4
	OLS; FEM; REM	OLS; FEM; REM	OLS; FEM; REM	OLS; FEM; REM
Constant	1.675***; 1.706***; 1.675***	1.917***; 2.092***; 1.925***	1.906***; 2.081***; 1.915***	1.920***; 2.085***; 1.920***
SIZE	0.103***; 0.102***; 0.103***	0.094***; 0.091***; 0.094***	0.094***; 0.091***; 0.094***	0.095***; 0.092***; 0.095***
CUS	-0.033**; -0.035**; -0.033***	-0.042***; -0.048***; -0.043***	-0.041***; -0.046***; -0.041***	-0.044***; -0.049***; -0.044***
AGE	-0.007; -0.019; -0.007	-0.005; -0.023; -0.005	-0.006; -0.024; -0.006	-0.007; -0.025*; -0.007
POL	0.037; 0.046**; 0.037	0.027; 0.035; 0.027	0.025; 0.033; 0.025	0.027; 0.035; 0.027
LOC	-0.015; -0.018; -0.015	-0.011; -0.012; -0.011	-0.009; -0.009; -0.009	-0.004; -0.004; -0.004
GRI/ESG	0.875***; 0.872***; 0.875***	0.871***; 0.868***; 0.871***	0.871***; 0.869***; 0.872***	0.876***; 0.873***; 0.876***
IA	0.175***; 0.179***; 0.175***	0.164***; 0.173***; 0.165***	0.165***; 0.174***; 0.166***	0.162***; 0.170***; 0.162***
FITA	0.893***; 0.873***; 0.893***	0.895***; 0.873***; 0.895***	0.896***; 0.874***; 0.897***	0.895***; 0.872***; 0.895***
H5		0.023; 0.014; 0.021	0.022; 0.013; 0.020	0.022; 0.015; 0.022
ID		-0.003; -0.027; -0.006	-0.003; -0.026; -0.006	-0.011; -0.032; -0.011
TOP10		0.025*; 0.038**; 0.025*	0.024*; 0.037**; 0.024*	0.028*; 0.041***; 0.028*
INTD			-0.009; -0.010; -0.009	0.104; 0.092; 0.104
H5×INTD				0.058***; 0.058***; 0.058***
ID×INTD				-0.035; -0.032; -0.035
TOP10×INTD				-0.009; -0.008; -0.009
Time	Controlled	Controlled	Controlled	Controlled
Firm	Controlled	Controlled	Controlled	Controlled
R^2	0.582; 0.582; 0.582	0.583; 0.583; 0.583	0.583; 0.583; 0.583	0.585; 0.585; 0.585
F	481.412***; 455.120***; N/A	350.939***; 332.970***; N/A	321.696***; 305.240***; N/A	259.032***; 245.550***; N/A
Wald Chi²	N/A; N/A; 3851.290***	N/A; N/A; 3864.690***	N/A; N/A; 3864.660***	N/A; N/A; 3885.480***
D.W. statistics	1.986; N/A; N/A	1.983; N/A; N/A	1.984; N/A; N/A	1.986; N/A; N/A

Note: *p≤0.10 (Two-tailed), **p≤0.05 (Two-tailed), ***p≤0.01 (Two-tailed). OLS, FEM, and REM are the abbreviations of the OLS regression, Fixed Effect Model, and Random Effect Model with the same as Table 4 and Table 5.

As Table 3, SIZE, GRI/ESG, IA, and FITA can all significantly improve SO no matter which test is used and whether considering the moderating effect of INTD (marginal effect within 9.10%~10.30%, 86.80%~87.60%, 16.20%~17.90%, and 87.20%~89.70%, respectively). This finding supports that CMFs with larger-size assets and stronger intention to well compile CSR report will more positively engage in SO. Further, more decentralized customer groups will motivate firms to positively engage in SO probably because it means that more groups are focusing on issues with respect to firms' operations management. CMFs' SO can help expand sales volume of green products, and consumers and government hold strong intentions to purchase them at present, which is also in line with the concept of green economy that is advocated by Chinese government (Ramasamy and Yeung, 2009). In this case, CMFs need to consider SO issues when they have broader audiences for their products to keep the diversification of current customer groups.

If not considering the moderating effect of INTD, i.e. Model 2 and Model 3, only TOP10 (2.40%~4.10%) significantly improves SO but H5 and ID not, thus verifying the leading role of government involvement with Hypothesis 3. Based on regression coefficients of H5 and ID, Hypothesis 1 is partially supported (not statistically significant but positive), but Hypothesis 2 is not supported. Considering China's context, these results portray following pictures. First, centralized ownership distribution indicates key shareholders can more firmly make decisions, but it does not mean that firms with higher H5 are bound to highly focus on SO. Overall, although H5 does not statistically significantly improve SO, it presents positive effect trend, which implies that most firms with high H5 can focus on SO in China. Second, ID does not significantly improve SO. Prior studies argued that independent director has a duty to objectively and independently evaluate firm development with curbing shareholders' behaviors that may impair stakeholders' interests (Cotter et al., 1997). According to the provision from China Securities Regulatory Commission, the proportion of independent directors in listed firms is required to be no less than 1/3 of total board members, but there are 101 firm-year observations whose ID is less than this data, which presents that few firms' GS is not in line with industry standard, and independent directors are still weak in supervising firms' sustainability. Third, the involvement of state-owned shares usually

motivates firms' SO. In practice, the broader state- owned properties and higher proportion of such share in CMFs indicate that they can own more kinds of available resources, e.g. monetary assets, raw materials, human resources, information, and technology. Further, most of Chinese state-owned firms have experienced the transformation of ownership structure, and with the volatility of state-owned shares, firms' overall orientations in fulfilling social responsibility may be adjusted, which indicates that this share-distribution may produce a direct effect on performance in terms of CSR than that of ownership property because the former can directly lead to the distribution of decision-making powers (Tam, 2002; Lu, 2009). Overall, state involvement can more robustly motivate CMFs' SO with the help of strict policy regulation and superiority of internal available resources.

When considering the effect of INTD, i.e. the Model 4, H5 is significantly positively moderated (5.80%), thus indicating that INTD promotes key shareholders to focus on SO. At present, China's manufacturing sector is making great efforts to enter international markets, and global impression on Chinese products will guide what international strategy CMFs develop in the future. Further, developing this strategy will act on the role of GS with a typical manifestation that key shareholders make full use of global market to improve SO. In this case, centralized ownership distribution, i.e. higher H5, can help firms to more easily develop SO plans (Deng, 2012). Overall, INTD only motivates one GS-related variable to more positively affect SO, and its weak effect echos the result of our correlation analysis that INTD can hardly positively correlates with GS-related variables. Thus Hypothesis is verified. Further, based on the data distribution of SO in our samples, it can be inferred that CMFs' SO will keep improving (Average of SO from 2010 to 2018 is 104.05, 126.93, 150.95, 161.49, 169.13, 184.87, 187.31, 190.48, and 238.15, respectively). Although the average of INTD presents a rising trend in our observation period (as 10.96, 11.68, 12.61, 12.34, 13.09, 12.35, 13.45, 13.71, 14.81, respectively), its moderating effect is limited. Thus the practical significance of INTD in CMFs' SO has not been fully concretized by now.

This paper further develops the robustness test to examine whether the volatility of our data is smooth through considering variables' time effect. Specifically, we multiply all variables with a time-term (year),

and then compare these regression results with that in Table 3. We find that all regression coefficients of robustness test are highly similar to that in Table 3, including both coefficients value and significance at the statistical level. Further, this paper develops the heterogeneity test based on different levels of INTD.

4.3. Heterogeneity test

This paper divides INTD into two groups by its average (12.74 as Table 1) to present whether higher INTD can play a better moderating effect with results as Table 4 and Table 5.

Table 4. The effect of GS on SO with higher INTD (N=861)

Variables	Model 1	Model 2	Model 3	Model 4
	OLS; FEM; REM	OLS; FEM; REM	OLS; FEM; REM	OLS; FEM; REM
Constant	2.065***; 2.133***; 2.065***	2.557***; 2.693***; 2.557***	2.560***; 2.695***; 2.560***	2.529***; 2.677***; 2.529***
SIZE	0.091***; 0.089***; 0.091***	0.080***; 0.078***; 0.080***	0.081***; 0.078***; 0.081***	0.084***; 0.081***; 0.084***
CUS	-0.075***; -0.078**; -0.075**	-0.083**; -0.087**; -0.083**	-0.089**; -0.093**; -0.089**	-0.096**; -0.100***; -0.096***
AGE	0.032; 0.031; 0.032	0.075***; 0.073***; 0.075***	0.076***; 0.073***; 0.076***	0.068**; 0.064**; 0.068***
POL	0.068; 0.076*; 0.068	0.063; 0.070; 0.063	0.064; 0.070; 0.064	0.069; 0.076*; 0.069
LOC	-0.024; -0.030; -0.024	-0.026; -0.030; -0.026	-0.031; -0.035; -0.031	-0.025; -0.029; -0.025
GRI/ESG	0.937***; 0.930***; 0.937***	0.934***; 0.927***; 0.934***	0.934***; 0.926***; 0.934***	0.932***; 0.926***; 0.932***
IA	0.249***; 0.257***; 0.249***	0.183**; 0.192**; 0.183**	0.183**; 0.192**; 0.183**	0.179**; 0.189**; 0.179**
FITA	0.819***; 0.805***; 0.819***	0.821***; 0.811***; 0.821**	0.818***; 0.808***; 0.818***	0.815***; 0.801***; 0.815***
H5		0.130***; 0.127***; 0.130***	0.129***; 0.125***; 0.129***	0.131***; 0.126***; 0.131***
ID		-0.059; -0.076; -0.059	-0.057; -0.073; -0.057	-0.063; -0.082; -0.063
TOP10		-0.027; -0.022; -0.027	-0.025; -0.021; -0.025	-0.015; -0.009; -0.015
INTD			0.014; 0.014; 0.014	-0.326; -0.388; -0.326
H5×INTD				0.067**; 0.069**; 0.067**
ID×INTD				0.092; 0.109; 0.092
TOP10×INTD				0.008; 0.009; 0.008
Time	Controlled	Controlled	Controlled	Controlled
Firm	Controlled	Controlled	Controlled	Controlled
R^2	0.566; 0.566; 0.566	0.573; 0.573; 0.573	0.573; 0.573; 0.573	0.576; 0.576; 0.576
F	138.793***; 128.460***; N/A	103.49***; 95.800***; N/A	94.822***; 87.770***; N/A	76.615***; 71.040***; N/A
Wald Chi²	N/A; N/A; 1110.350***	N/A; N/A; 1138.400***	N/A; N/A; 1137.870***	N/A; N/A; 1149.230***
D.W. statistics	2.004; N/A; N/A	2.017; N/A; N/A	2.019; N/A; N/A	2.009; N/A; N/A

Table 5. The effect of GS on SO with lower INTD (N=1,914)

Variables	Model 1	Model 2	Model 3	Model 4
	OLS; FEM; REM	OLS; FEM; REM	OLS; FEM; REM	OLS; FEM; REM
Constant	1.542***; 1.588***; 1.542***	1.674***; 1.904***; 1.682***	1.679***; 1.917***; 1.687***	1.668***; 1.909***; 1.677***
SIZE	0.107***; 0.105***; 0.107***	0.098***; 0.093***; 0.098***	0.097***; 0.092***; 0.098***	0.097***; 0.092***; 0.097***
CUS	-0.018; -0.020; -0.018	-0.034**; -0.042**; -0.034***	-0.034**; -0.042**; -0.034**	-0.035**; -0.043**; -0.035**
AGE	-0.026*; -0.044***; -0.026*	-0.039**; -0.066***; -0.040**	-0.039**; -0.066***; -0.040**	-0.040**; -0.067***; -0.040**
POL	0.016; 0.028; 0.016	0.010; 0.024; 0.010	0.011; 0.024; 0.011	0.009; 0.022; 0.009
LOC	-0.007; -0.009; -0.007	0.000; 0.000; 0.000	0.000; 0.000; 0.000	0.000; -0.001; -0.001
GRI/ESG	0.841***; 0.837***; 0.841***	0.840***; 0.845***; 0.847***	0.847***; 0.844***; 0.847***	0.845***; 0.843***; 0.846***
IA	0.138***; 0.145***; 0.138***	0.143***; 0.156***; 0.144***	0.142***; 0.156***; 0.144***	0.143***; 0.156***; 0.144***
FITA	0.933***; 0.910***; 0.933***	0.931***; 0.904***; 0.931***	0.931***; 0.904***; 0.931***	0.931***; 0.904***; 0.931***
H5		-0.020; -0.033; -0.023	-0.020; -0.032; -0.023	-0.020; -0.032; -0.022
ID		0.036; 0.012; 0.033	0.035; 0.011; 0.033	0.040; 0.015; 0.037
TOP10		0.049***; 0.068***; 0.050***	0.049***; 0.068***; 0.050***	0.048***; 0.068***; 0.049***
INTD			0.001; 0.004; 0.001	0.042; 0.051; 0.037
H5×INTD				0.002; 0.006; 0.003
ID×INTD				-0.012; -0.013; -0.010
TOP10×INTD				-0.014; -0.016; -0.014
Time	Controlled	Controlled	Controlled	Controlled
Firm	Controlled	Controlled	Controlled	Controlled
R^2	0.594; 0.593; 0.594	0.595; 0.594; 0.595	0.595; 0.594; 0.595	0.595; 0.595; 0.595
F	347.786***; 332.140***; N/A	253.814***; 244.270***; N/A	232.543***; 223.820***; N/A	185.881***; 178.940***; N/A
Wald Chi²	N/A; N/A; 2782.290***	N/A; N/A; 2797.290***	N/A; N/A; 2795.840***	N/A; N/A; 2793.590***
D.W. statistics	2.021; N/A; N/A	2.012; N/A; N/A	2.012; N/A; N/A	2.013; N/A; N/A

Compared with the full sample, in case of higher INTD, longer AGE can significantly positively affect SO as Model 2, Model 3, and Model 4. This result describes that CMFs with richer operations experience will perform better SO, and such experience may also broadly affect the development of other operations levels. Table 4 presents that H5 significantly improves SO (12.50%~13.10%) with higher INTD, and INTD can motivate H5 to keep this effect trend (6.70%~6.90%). This case indicates that centralized shareholding structure will lead CMFs to focus more on SO with higher INTD, and this international strategy can also promote key shareholders to organize more sustainable manners to external stakeholders. That is, higher INTD can be viewed as an incentive for enhancing key shareholders' concern on SO. In contrast, as Table

5, TOP10 significantly improves SO (4.80%~6.80%), but INTD has not driven any GO-related variables to improve SO. This finding further supports the basic effect of state-owned shares in leading SO, i.e. state involvement acting on improving SO when INTD is lower. Above analysis on INTD verifies Hypothesis 5, but compared with our control variables, the interaction between GS and INTD still has a less effect on SO with higher INTD. This case indicates that CMFs' SO is often led by firms' profiles and shareholders' willingness to spread favorable firms' image to the public. Overall, heterogeneity test presents that lower INTD is not feasible to promote CMFs' SO, but improving INTD can reserve this headwind. Although it exists some disparities on empirical results between these two grouping tests, both can jointly describe a picture that key shareholders and state-owned shares usually state-owned shares. In the long-term, key shareholders' sustainable development perception requires an in-depth concern because compared with state involvement (TOP10), higher INTD only promotes H5 to improve SO, which suggests driving key shareholders to play a stable effect in CMFs' SO. Integrating above analysis, we summarize the results of all hypotheses in Table 6.

Table 6. The summary of hypotheses test results

Hypotheses	Related variables	Expected sign	Actual sign	Supported or not
Hypothesis 1. Ownership concentration positively affects CMFs' SO.	H5, SO	(+)	(+)	Partially supported
Hypothesis 2. The size of independent directors positively affects CMFs' SO.	ID, SO	(+)	(-)	Not supported
Hypothesis 3. State-holding intensity positively affects CMFs' SO.	TOP10, SO	(+)	(+)***	Supported
Hypothesis 4. The moderating effect of CMFs' INTD in the relationship between GS and SO is positive but limited.	GS, INTD, SO	(+)	N/A	Supported
Hypothesis 5. Higher CMFs' INTD leads to a more positive effect of GS on SO.	GS, INTD, SO	(+)	N/A	Supported

Note: ***$p < 0.01$.

5. Research implications

5.1. Theoretical implications of linking firms' internationalization and SO

Above empirical tests will enhance the understanding of the moderating effects of internationalization

in linking GS and SO in CMFs. Although we find that INTD does not well moderate their relationship, it still improve the effect of key shareholders and state-owned shares in SO. Existing literature on firms' SO generally lacks observations on the effect of their globalization, which leaves a key question unanswered, i.e. how to enhance top management's focus on firms' sustainability through exporting products in view of global expansion and increasing perceptions of green manufacturing. Prior research investigated how internationalization will affect firms' sustainability, but they did not analyze whether their globalization that is still in an infancy in emerging economies can alter GS propensity (González-Benito and González-Benito, 2006). To answer this question, we establish a link of GS, INTD, and SO in a unified conceptual model based on the Agency Theory and Resource-based Theory, thus expanding the theory application of internationalization in following aspects. First, compared with prior studies that analyzed how firms' GS affects performance indicators, we incorporate the internationalization that CMFs increasingly focus on into this process to highlight its potential effect between GS and SO. This paper theoretically expands the role of internationalization in firms' social issues. Although our findings present the limited effect of INTD, they support that international strategy should be given a high priority in the decision-making of firms' sustainability. Motivated by Lu et al. (2014), the limited moderating effect of INTD suggests more closely linking with GS-related indicators, e.g. top management team, to explain how INTD can improve the initial intention of GS.

Second, the expanded research perspectives on firms' INTD in recent years further suggest identifying more indicators that appeared in firms' operations management and thus analyze their link with GS and SO. This work will help involve indicators closely related to basic features of modern firms in the field of SO, thus presenting what indicators can innovatively improve SO, especially in manufacturing industry that face a dilemma of how to improve sustainability.

Third, our conceptual model helps expand the application of Agency Theory in firms' SO. Examining the moderating role of internationalization involves a key research perspective that domestic firms' top management act as the client to respond to public expectations in terms of firms' sustainability, and their

consumers are seen as the agent who can help evaluate the state of firms' SO even if they have not overly concerned about it. This work enlightens that firms' external factors can act as an agent to drive internal operations, thus top management can more broadly seek resources to enhance firms' competitive edges.

5.2. Managerial implications for SO in CMFs

The lower average of INTD in Table 1 and its limited moderating effect in CMFs provide the following managerial implications. First, they should expand global market shares by means of national industrial policies, e.g. *Made in China 2025*, to create competitive edges in terms of global products coverage. Spring et al. (2017) argued that in high-cost economies, industrial policy can prevent the failure in the process of turning innovation system into business performance. Thus CMFs should be suggested to systematically formulate international strategies through following policy steering because in the process of creating SO, they also need to pay the high management cost, but positive policy release may decrease such high cost.

Second, the disparity of firms' internationalization that is caused by regional heterogeneity should be concerned by Chinese government because the average INTD of CMFs in Non-eastern provinces (8.68) is markedly lower than that in the Eastern (15.34), which indicates that geographical location can affect the actual state of firms' international strategies. Further, the average SO of CMFs in the Non-eastern (151.16) is lower than that in the Eastern (175.42), which further portrays the demerits in both sustainability and broad market of manufacturing sectors in China's less-developed regions. The data distribution of INTD and SO in these two regions indicates that they may have an inner relevance because in one region, these two indicators present a trend of co-movement. To improve it, government should vigorously motivate CMFs located in the Non-eastern for expansion of international channels through policy tools to break a situation where they only focus on domestic markets or dare to not to enter international fields.

Third, besides policy regulation that can be described by state-owned shares or other policy tools, key shareholders awareness to internationalization is also an irreplaceable driving force for improving INTD, which can be verified by significantly positive effects of H5 and SO in case of higher INTD. Therefore, to improve CMFs' SO, key shareholders' preference for international strategy should be also considered in

future management.

Fourth, from the perspective of internal supervision, ID has not significantly positively affected SO all the time, and Table 1 presents that average ID (37.30) is only little higher than China' criterion. This case may restrict independent directors' monitoring duties, and in future managerial practices, CMFs should strictly abide by policy regulations to arrange independent directors who should be endowed with more rights to supervise SO.

5.3. Implications within international perspectives of linking INTD and SO

With the broader practice of global engineering network around the world, SO is gradually integrated into a unified framework (Zhang et al., 2016; Zhang et al., 2018). These practices imply that more actions with globalization feature will appear in manufacturing sectors, thus accelerating industrial clusters, and international strategy will be a key path for globally recovering manufacturing economies. The program of *Made in China 2025* is motivating CMFs to enter international markets, but the intensive data collected by this paper from listed firms that can be seen as the leader of China's manufacturing industry presents a lower INTD with a large disparity among firms as the value of S.D. in Table 1. This case also implies that INTD of small-and medium-sized CMFs is not very optimistic, and the contrast aiming at process of advanced manufacturing between Western countries and China reveals that developing economies need to positively integrate into international markets. SO is presenting a positive state worldwide, and firms' sustainability practices are creating more competitive edges (Miroshnychenko et al., 2017). Accordingly, how to promote domestic competitive products to involve in globalization has practical significances for developing economies. In this case, such economy that takes the lead in marketing products to overseas markets will motivate domestic economic growth through multi-channel market expansions. Thus it can be seen that developing economies should enhance the positive interaction between internationalization and SO.

Further, based on the definition of SO, this operations from the global perspective requires a rigorous coordination of ecological, economic, and societal elements. From this view, our results echo an expected

theoretical contribution that global visions play a key effect in firms' overall greenization. To emerging economies, widely developing cleaner production was seen as critical to improve these three elements in an all-round way, and this view was extensively studied (Kolk, 2016; Miroshnychenko et al., 2017; Yang et al., 2019). It is universally acknowledged that manufacturing sectors should robustly undertake social responsibility (Fernandez- Feijoo et al., 2014), thus focusing on cleaner production can be seen as the core at the level of entirely improving SO.

6. Conclusions

Through surveying 2,775 firm-year observations of CMFs, this paper examines the effect of GS on SO under the moderating effect of INTD. Further, we examine whether higher INTD will play a better effect with a robustness test aiming at data stationarity. The descriptive statistics present a lower level of INTD in CMFs, which indicates that quite a number of listed CMFs have not broadly engaged in global market expansion, and their products flow is in the blocked as a whole. Empirical results indicate that intensive state-holding (TOP10) can significantly improve SO, but the effect of firms' independent directors (ID) is not significantly positive. Further, INTD significantly positively improves the effect of H5 on SO, and its higher level can significantly motivate H5 to focus on SO, but lower INTD does not play the moderating effect on any GS-related indicator for significantly improving SO. Additionally, ID cannot improve SO no matter whether INTD is considered in the conceptual mode. Overall, empirical tests support a relatively positive effect of H5 and TOP10, but independent directors' monitoring duty has not played such effect. Out results indicate that CMFs with centralized GS are more likely to develop SO, and their globalization process will provide an approach to help closely link corporate governance and sustainable development. For CMFs that face a dilemma of enhancing sustainability, focusing on overseas markets will lead to their governance mode presenting features of sustainable development in terms of operations management.

To expand the conceptual model in this paper, future research needs to be organized to fill in our gap as follows. First, GS-related indicators should be further considered at individual level, e.g. CEOs' profile,

because prior research found that top management's profile can act on the change of firms' sustainability (Walls et al., 2012). For instance, Buil-Fabregàet al. (2017) argued that compared with the male managers, women's gentle personality will drive them to be more sensitive to firms' social behaviors, thus capturing information more helpful to enhance firms' social value. As our data is collected from firm-level reports and financial websites, we encounter a difficulty in data-collection at CEO level, which suggests using a variety of methods to collect data on managers' own profile to present the power of key stakeholders in firms' sustainability. Second, more internationalization-related indicators should be considered, e.g. FDI, to broadly present how international trade leads to firms' SO. The size of exported products can describe the extent to which foreign customers acknowledge the quality of products that are from CMFs, but this acknowledgement is also manifested in overseas investors' direct investment in CMFs. Therefore, more paths on the effect of INTD on SO need to be tested. What's more, to address severe pollutant emissions and huge pressure from world opinions, improving CMFs' SO will make great efforts to mitigate global climate change. However, it exists few research designing CMFs' SO mode based on business operations, but this attempt can help more closely and robustly link business activities and sustainable development. Finally, as discussions on managerial implications in Sub-section 5.2, industrial policy should be seen as a tool for linking INTD and SO in view of the competitive edges they create for operations management (Spring et al., 2017). Therefore, embedding policy regulations in the path of improving SO can be seen as a new topic area for future research.

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